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# $3^{18}$ Series of Encoders

## Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Three words transmission
- Built-in oscillator needs only 5% resistor
- Easy interface with an RF or infrared transmission media
- Minimal external components

## Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

## General Description

The $3^{18}$ encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding 18 bits of information which consists of N address bits and 18–N data bits. Each address/data input is externally trinary programmable if bonded out. It is otherwise set floating internally. Various packages of the $3^{18}$ encoders offer flexible combinations of programmable address/data to meet various application needs. The programmable address/data is transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger type or a DATA trigger type further enhances the application flexibility of the $3^{18}$ series of encoders.

## Selection Table

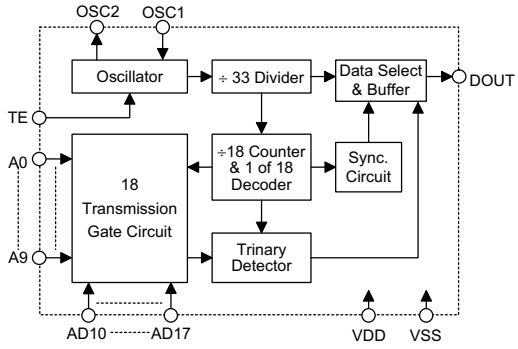
| Function / Part No. | Address No. | Address/ Data No. | Data No. | Dummy Code No. | Oscillator | Trigger | Package |
|---|---|---|---|---|---|---|---|
| HT600 | 9 | 5 | 0 | 4 | RC oscillator | TE | 20 DIP/20 SOP |
| HT640 | 10 | 8 | 0 | 0 | RC oscillator | TE | 24 SOP/24 SDIP |
| HT680 | 8 | 4 | 0 | 6 | RC oscillator | TE | 18 DIP |
| HT6187 | 9 | 0 | 3 | 6 | RC oscillator | D12,D14,D15 | 18 DIP/20 SOP |
| HT6207 | 10 | 0 | 4 | 4 | RC oscillator | D12~D15 | 20 DIP/20 SOP |
| HT6247 | 12 | 0 | 6 | 0 | RC oscillator | D12~D17 | 24 SOP/24 SDIP |

Note: Address/Data represents addressable pins or data according to the decoder requirements.

## Block Diagram

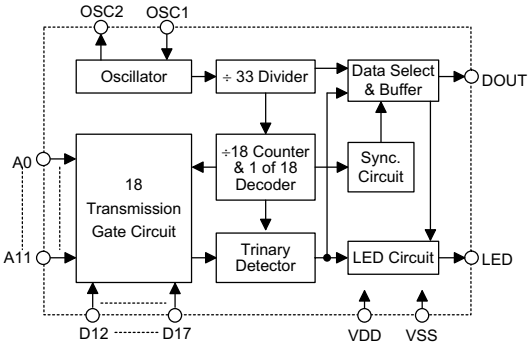
**TE trigger**

HT600/HT640/HT680




**DATA trigger**

HT6187/HT6207/HT6247

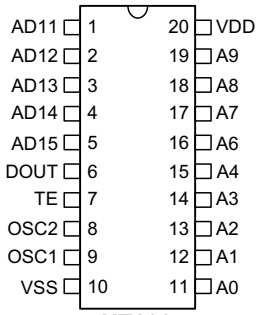



Note: The address/data pins are available in various combinations.

## Pin Assignment

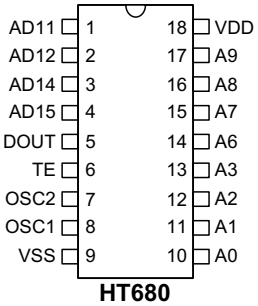
**TE trigger type**

**9-Address**
**5-Address/Data**



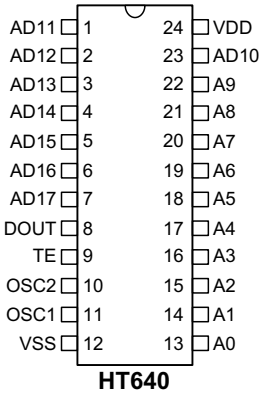

**HT600**
**– 20 DIP/SOP**

**8-Address**
**4-Address/Data**




**HT680**
**– 18 DIP/SOP**

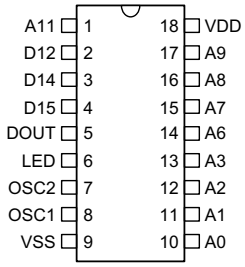
**10-Address**
**8-Address/Data**




**HT640**
**– 24 SOP/SDIP**

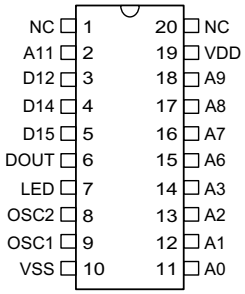
**DATA trigger type**

**9-Address 3-Data**



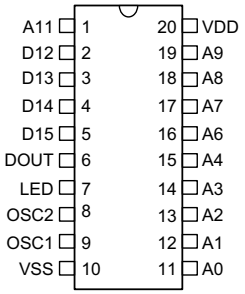

**HT6187 – 18 DIP**

**9-Address 3-Data**



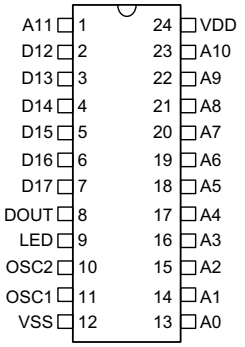

**HT6187 – 20 SOP**

**10-Address 4-Data**




**HT6207 – 20 DIP/SOP**

**12-Address 6-Data**




**HT6247 – 24 SOP/SDIP**

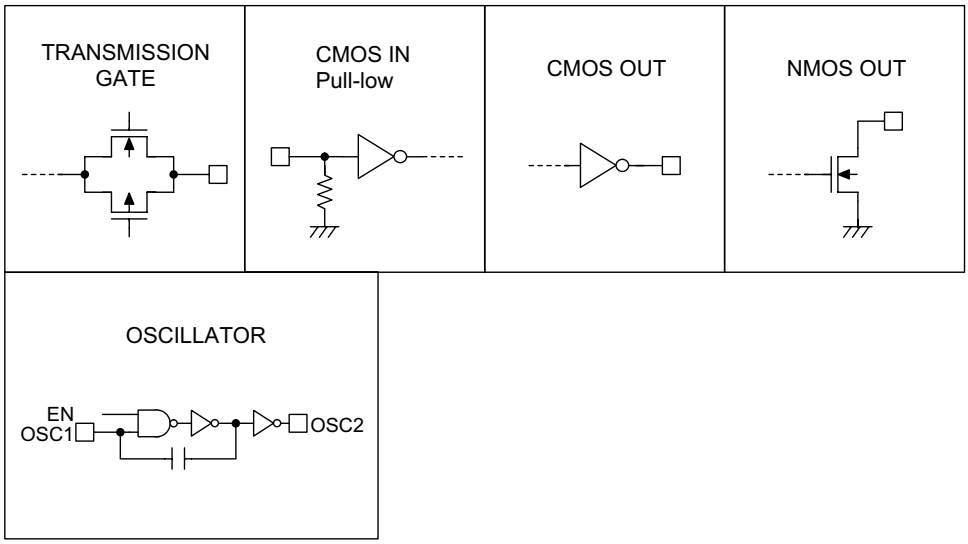
## Pin Description

| Pin Name | I/O | Internal Connection | Description |
|---|---|---|---|
| A0~A11 | I | TRANSMISSION GATE | Input pins for address A0~A11 setting<br>They can be externally set to VDD, VSS, or left open. |
| AD10~AD17 | I | TRANSMISSION GATE | Input pins for address/data (AD10~AD17) setting<br>They can be externally set to VDD, VSS, or left open. |
| D12~D17 | I | CMOS IN<br>Pull-low | Input pins for data (D12~D17) setting and transmission enable (active high)<br>They an be externally set to VDD or left open (see Note). |
| DOUT | O | CMOS OUT | Encoder data serial transmission output |
| LED | O | NMOS OUT | LED transmission enable indicator |
| TE | I | CMOS IN<br>Pull-low | Transmission enable, active high (see Note). |
| OSC1 | I | OSCILLATOR | Oscillator input pin |
| OSC2 | O | OSCILLATOR | Oscillator output pin |
| VSS | I | — | Negative power supply (GND) |
| VDD | I | — | Positive power supply |

Notes: D12~D17 are data input and transmission enable pins of the HT6187/HT6207/HT6247.

TE is the transmission enable pin of the HT600/HT640/HT680.

**Approximate internal connection circuits**




## Absolute Maximum Ratings

Supply Voltage.....–0.3V to 13V
Storage Temperature.....–50°C to 125°C
Input Voltage .....$V_{SS}$–0.3 to $V_{DD}$+0.3V
Operating Temperature .....–20°C to 75°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

## Electrical Characteristics

Ta=25°C

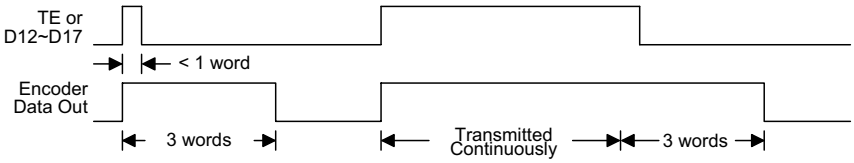
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{DD}$ | Conditions | | | | |
| $V_{DD}$ | Operating Voltage | — | — | 2.4 | — | 12 | V |
| $I_{STB}$ | Standby Current | 3V | Oscillator stops | — | 0.1 | 1 | μA |
| | | 12V | | — | 2 | 4 | μA |
| $I_{DD}$ | Operating Current | 5V | No load $f_{OSC}$=100kHz | — | 250 | 500 | μA |
| | | 12V | | — | 1200 | 2400 | μA |
| $I_{LED}$ | LED Sink Current | 5V | $V_{LED}$=0.5V | 1.5 | 3 | — | mA |
| $I_{DOUT}$ | Output Drive Current | 5V | $V_{OH}$=0.9$V_{DD}$ (Source) | –0.6 | –1.2 | — | mA |
| | | 5V | $V_{OL}$=0.1$V_{DD}$ (Sink) | 0.6 | 1.2 | — | mA |

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | | $V_{DD}$ | Conditions | | | | |
| $V_{IH}$ | "H" Input Voltage | — | — | $0.8V_{DD}$ | — | VDD | V |
| $V_{IL}$ | "L" Input Voltage | — | — | 0 | — | $0.2V_{DD}$ | V |
| $f_{OSC}$ | Oscillator Frequency | 10V | $R_{OSC}$=330kΩ | — | 100 | — | kHz |
| $R_{TE}$ | TE Pull-low Resistance | 5V | $V_{TE}$=5V | — | 1.5 | 3 | MΩ |
| $R_{DATA}$ | D12~D17 Pull-low Resistance | 5V | $V_{DATA}$=5V | — | 1.5 | 3 | MΩ |

## Functional Description

### Operation

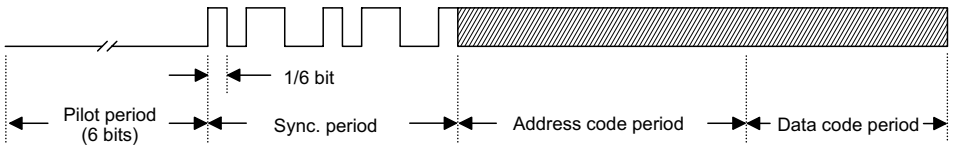
The $3^{18}$ series of encoders begins a three-word transmission cycle upon receipt of a transmission enable (TE for the HT600/HT640/HT680 or D12~D17 for the HT6187/HT6207/HT6247, active high). This cycle will repeat itself as long as the transmission enable (TE or D12~D17) is held high. Once the transmission enable falls low, the encoder output completes its final cycle and then stops as shown below.




Transmission timing

### Information word

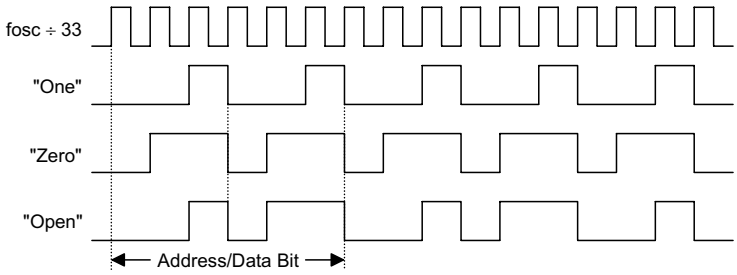
An information word consists of 4 periods as shown:




Composition of information

### Address/data waveform

Each programmable address/data pin can be externally set to one of the following three logic states:




Address/Data bit waveform

The "Open" state data input is interpreted as logic low by the decoders since the decoder output only have two states.

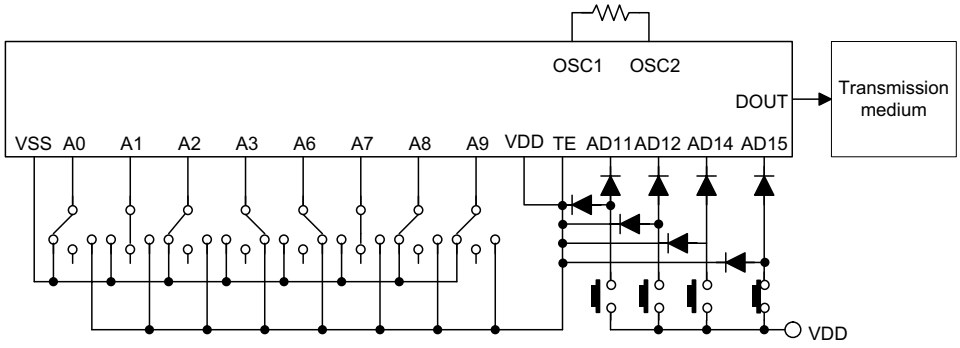
### Address/data programming (preset)

The status of each address/data pin can be individually preset to logic "high", "low", or "floating". If a transmission enable signal is applied, the encoder scans and transmits the status of the 18 bits of address/data serially in the order A0 to AD17 for the HT600/HT640/HT680 and A0 to D17 for the HT6187/HT6207/HT6247.

There are some packaging limitations. The 18-pin DIP HT680, for example, offers four external data bits and eight external address bits. The remaining unpackaged bits or dummy codes are treated as floating for A0~AD17 or as pull-low for D12~D17. During an information transmission these bits are still located in their original position. But if the trigger signal is not applied, the chip only consumes a standby current which is less than 1μA.

The address pins are usually preset to transmit data codes with particular security codes by the DIP switches or PCB wiring, while the data is selected using push buttons or electronic switches.

The following figure shows an application using the HT680:



The transmitted information is as shown:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pilot & Sync.** | A0<br>0 | A1<br>Z | A2<br>0 | A3<br>1 | A4<br>Z | A5<br>Z | A6<br>1 | A7<br>Z | A8<br>0 | A9<br>0 | AD10<br>Z | AD11<br>Z |
| — | AD12<br>Z | AD13<br>Z | AD14<br>Z | AD15<br>1 | AD16<br>Z | AD17<br>Z | | | | | | |

Z: floating

### Address/Data sequence

The following provides a table of address/data sequence for various models of the $3^{18}$ series encoders. A correct device should be selected according to the individual address and data requirementss.

| **Part No.** | **Address/Data Bits** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0~3 | 4 | 5 | 6~9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| HT600 | A0~A3 | A4 | — | A6~A9 | — | AD11 | AD12 | AD13 | AD14 | AD15 | — | — |
| HT640 | A0~A3 | A4 | A5 | A6~A9 | AD10 | AD11 | AD12 | AD13 | AD14 | AD15 | AD16 | AD17 |
| HT680 | A0~A3 | — | — | A6~A9 | — | AD11 | AD12 | — | AD14 | AD15 | — | — |
| HT6187 | A0~A3 | — | — | A6~A9 | — | A11 | D12 | ═ | D14 | D15 | ═ | ═ |
| HT6207 | A0~A3 | A4 | — | A6~A9 | — | A11 | D12 | D13 | D14 | D15 | ═ | ═ |
| HT6247 | A0~A3 | A4 | A5 | A6~A9 | AD10 | A11 | D12 | D13 | D14 | D15 | D16 | D17 |

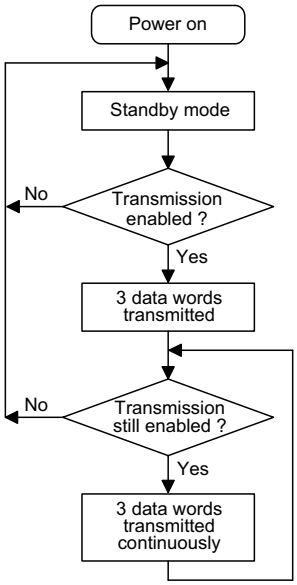
Notes: "—" is a dummy code which is left "open" and not bonded out.

"═" is a dummy code which is set low and not bonded out.

### Transmission enable

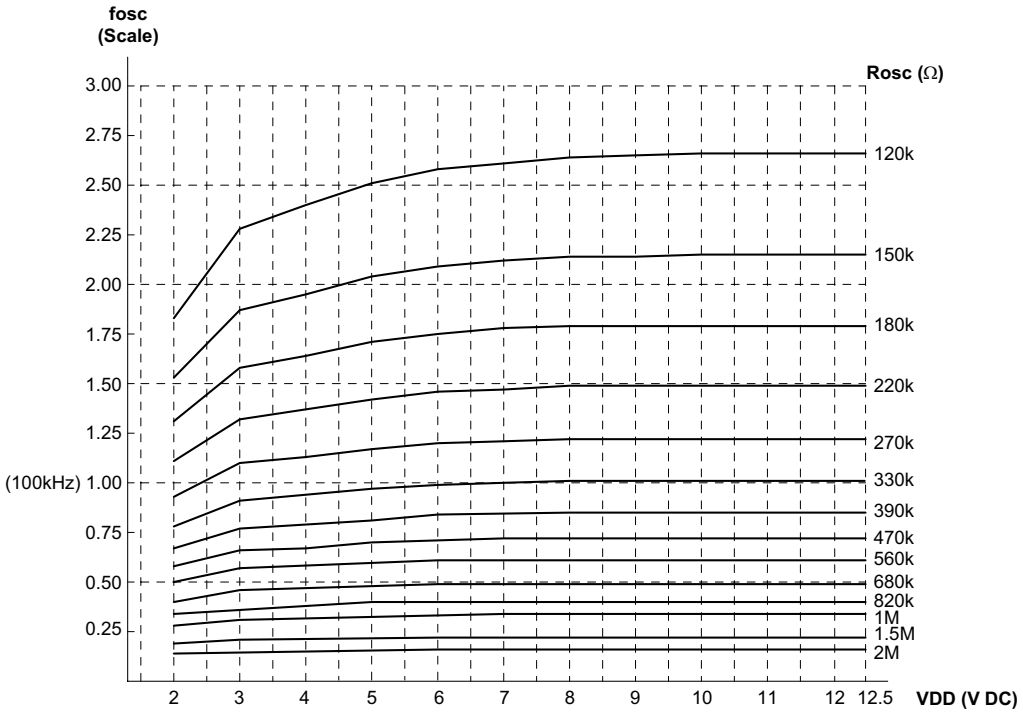
For the TE trigger type of encoders, transmission is enabled by applying a high signal to the TE pin. But for the Data trigger type of encoders, it is enabled by applying a high signal to one of the data pins D12~D17.

**Flowchart**



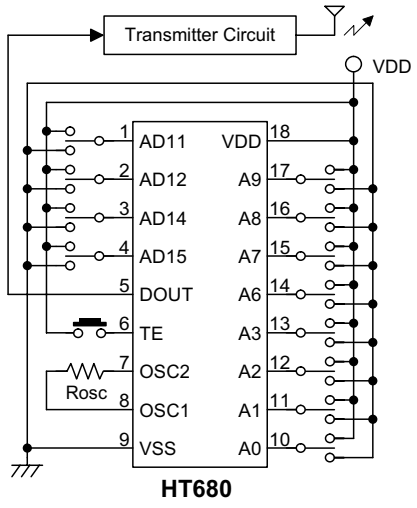

Notes: D12~D17 are transmission enables of the HT6187/HT6207/HT6247.
TE is the transmission enable of the HT600/HT640/HT680.

**Oscillator frequency vs supply voltage**

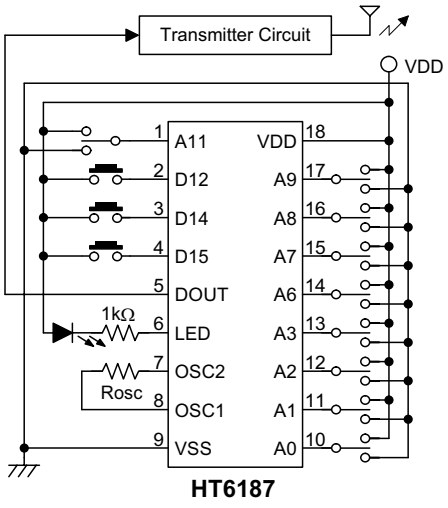



The recommended oscillator frequency is $f_{OSCD}$ (decoder) ≅ $f_{OSCE}$ (encoder).

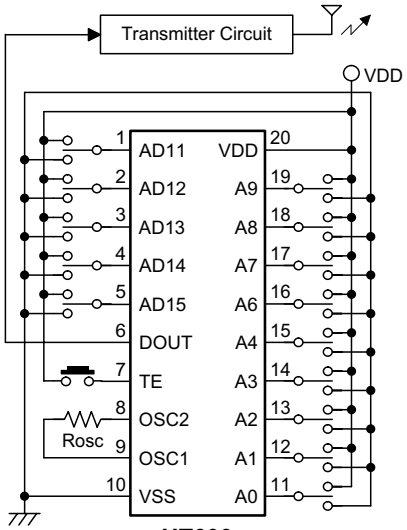
## Application Circuits



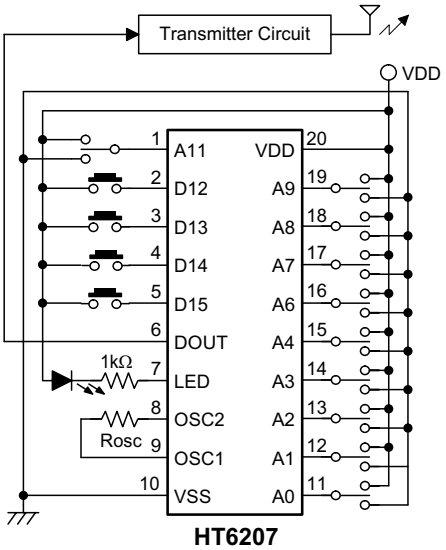

HT680



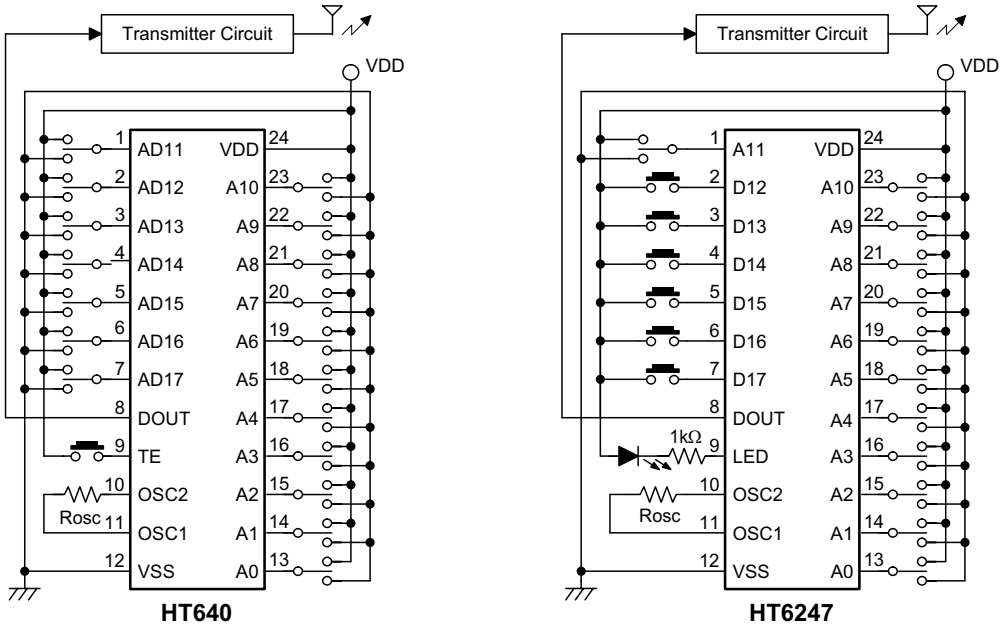

HT6187




HT600




HT6207




Notes: Typical infrared diode: EL-1L2 (KODENSHI CORP.)
Typical RF transmitter: JR-220 (JUWA CORP.)
TX-99 (MING MICROSYSTEM, U.S.A.)

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